

CLAIMS

- 1 1. A magnetic memory cell comprising:
2 a first magnetic layer;
3 a second magnetic layer; and
4 a nonmagnetic spacer layer disposed between the first and second layers for
5 coupling the first and second layers to be parallel in zero field.
- 1 2. The magnetic memory cell of claim 1 wherein the first layer is thicker than the
2 second layer.
- 1 3. The cell of claim 1 wherein the first and second layers have substantially equal
2 thicknesses.
- 1 4. The cell of claim 2 wherein the first layer is thicker than the second layer by a
2 factor of two or more.
- 1 5. The cell of claim 4 wherein the first layer is thicker than the second layer by a
2 factor of two or more and no greater than six.
- 1 6. The cell of claim 1 wherein the coupling is strong enough to couple the layers
2 in parallel when they point in easy direction and weak enough so that the layers are
3 coupled non-parallel when the layers point in the hard axis direction.

- 1 7. The cell of claim 1 wherein the nonmagnetic spacer layer comprises one of an
2 element or alloy that provides an amount of exchange coupling that results in
3 antiparallel switching of logic state.
- 1 8. The cell of claim 7 wherein the element or alloy comprises one of the group
2 consisting of Ru, Os, Re, Rh, Mo, Ir, Cr, Cu, and V.
- 1 9. The cell of claim 1 wherein the nonmagnetic spacer layer comprises a spacer
2 material for providing a very large parallel coupling and a dusting layer for
3 reducing the coupling.
- 1 10. The cell of claim 9 wherein the spacer material comprises a Ru layer.
- 1 11. The cell of claim 10 wherein at least one of the surfaces of the Ru layer is
2 dusted with another material for reducing the coupling between the first and
3 second magnetic layers.
- 1 12. The cell of claim 1 wherein the two magnetic layers separated only by a thin
2 layer of a nonmagnetic material comprising pinholes.
- 3 13. The cell of claim 6 wherein the coupling is weak enough to couple the layers
4 anti-parallel when the layers point in the hard axis direction.

1 14. A cell for coupling a first magnetic layer to a second magnetic layer
2 comprising:

3 introducing a nonmagnetic layer disposed between the first and second
4 magnetic layers for coupling the first and second layers to be parallel in zero field.
5

6 15. The method of claim 14 further comprising providing first and second layers
7 having substantially equal thicknesses.

1 16. The method of claim 14 further comprising providing first and second layers
2 wherein the first layer is thicker than the second layer by a factor of two or more.

1 17. The method of claim 14 further comprising providing a first layer that is
2 thicker than the second layer by a factor of two or more and no greater than six.

1 18. The method of claim 14 further comprising providing a coupling that is strong
2 enough to couple the layers in parallel when they point in easy direction and weak
3 enough so that the layers are coupled anti-parallel when they point in the hard axis
4 direction.

1 19. The method of claim 14 further comprising providing a nonmagnetic spacer
2 layer that comprises one of an element or alloy that provides an amount of exchange
3 coupling that results in antiparallel switching of logic state.

1 20. The method of claim 14 further comprising providing a nonmagnetic spacer
2 layer that comprises a spacer material which gives very large parallel coupling and a
3 dusting layer for reducing the coupling.

1 21. The method of claim 14 further comprising providing a Ru layer dusted with a
2 few Angstroms of another material that produces a much smaller coupling for
3 reducing the coupling between the first and second magnetic layers.